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UBIQUITOUS COMPUTING:
TRUST AND PRIVACY PROBLEMS WITH EMERGING TECHNOLOGIES

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INTRODUCTION

Ubiquitous computing (ubicomp) heralds a near future in which humans will be surrounded by 'always-on', unobtrusive, interconnected intelligent objects. The ubicomp vision involves a fully computerised society that includes multiple stakeholders, delivering services and exchanging information in a timely, convenient and appropriate fashion. However, people already have concerns over personal data storage, exchange, mining and unauthorized access by third parties.

The seamless exchange of information is what makes ubicomp tick, therefore databases stored with a host of information about the individual are crucial if this vision is to be realised. For example, in the UK the proposed introduction of the National Identity Register and Card has resulted in high levels of public concern. A central database will hold up to 51 pieces of information about an individual ranging from a name to biometric details.

The aim of this study is to develop a better understanding of how different levels of disclosure might be associated with the maintenance and communication of electronic identities. We are interested in knowing more about user requirements for privacy, trust and identity management in a ubiquitous computing world. In short, we are interested in the cost and benefits associated with ubicomp.

METHOD

- Key stakeholders provided specific scenarios illustrating the ways in which privacy, trust and identity information might be exchanged in the future.
- Four scenarios developed, related to health, e-voting, shopping and finance
- Scenarios scripted and scenes videotaped in context to develop Videotaped Activity Scenarios (VASc).
- VASc's were shown to thirty-eight focus groups (N=304). Representative groups from the elderly, the disabled and from different ethnic sectors included
- Participants watched scenarios and contributed to informal discussions on privacy and trust permissions for this type of technology
- All group discussions were transcribed then read; a sentence-by-sentence analysis was employed. The findings related to the health scenario are described in this paper

RESULTS

All discussions were transcribed and analysed using the Atlas.ti™ qualitative software programme. The data was open coded using qualitative techniques and several constructs were identified. These constructs were found to be interrelated and multidimensional. For clarity and ease of interpretation the constructs were further analysed and grouped based on Hertzberg et al's (1959) Two Factor Theory of Motivation. Table 1 depicts the main groupings of Motivators, Benefits, Costs and Social Implications.

Motivators	**Benefits**	**Social implications**
Credible Secure Reliable Accurate Transparent Context aware Personalised Easy to use Accessible	Better health-care Convenience ↕ Inflexibility Profile abuse Surveillance **Costs**	Over-reliance Dehumanisation Bystander apathy Reduced social interaction Enforced participation Health risks Environmental issues

Table 1: Grouping and constructs associated with use of an AmI

SUMMARY

The framework used in this study to evaluate trust and privacy has revealed motivation, cost/benefit and social implications as major constructs that will influence ubicomp adoption and use. We need to understand user motivation and how ubicomp systems can be made secure and at the same time transparent. Consideration must also be given to the costs, benefits and social implications incurred when using a ubicomp system. Within the framework used in this study the concepts of trust and privacy emerged as interrelated and multidimensional constructs. These constructs have underlying factors that dynamically change according to context.

Discussion also highlighted the complex nature of human behaviour. Participants commented behaviour is not always predictable and humans have complex relationships with others. Setting preferences for who has access to their personal information at any one point in time as difficult and socially unacceptable. Participants agreed ubicomp systems would have to be fully transparent and accessible at all times so people could verify what information was stored about them. For ubicomp systems to truly work total honesty between stakeholders and users was seen as a major concept.

Reference: Herzberg, F., Mausner, B., & Snyderman, B. B. (1959). *The Motivation to Work* (2nd ed.). New York: John Wiley & Sons.

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